NOTES ON THE VICTORIAN SPECIES OF *BULLINUS*.

BY

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(Plates 1-11.)

Those fresh water snails once known in Australia as *Physa*, but now referred to as *Bullinus*, have recently acquired an unpleasant interest. For the spread and nurture of hæmatura, a severe, painful and incurable complaint, has recently been traced to Egyptian representatives of *Bullinus*.

The newly hatched embryo of a Trematode, called *Bilharzia*, enters the *Bullinus* snail and there turns into a sporocyst. Then Bilharzid cercariæ are discharged from the infected snail every day for weeks, more plentifully and continuously in summer. The free-swimming larvæ swarm on the surface of the water in search of a victim. Should they fail to find a host within forty-eight hours they must die. A successful parasite enters the human body either by the mouth or through the skin, and proceeds to establish itself in the rectum or bladder. Arrived at maturity, the parasite sheds innumerable hard-shelled eggs. These erode the mucous membrane, thus causing internal bleeding, a symptom of the disease. Victims may even die from necrosis of the liver or blockage of portal veins.[1]

It is presumed if this plague were to be introduced into the Commonwealth from Africa or Asia that the Australian species of *Bullinus* would be ready at any time or place to serve as an intermediate host and so transmit it. Previously an Australian *Bullinus* had been indicted as an intermediate host for the sheep fluke.

The genus thus acquires an importance for medical and official circles. Hence the demand on Conchologists for exact determination of these shells and the present effort to improve the unsatisfactory current nomenclature and identification.

In 1881, a Catalogue of Australian and Tasmanian Freshwater Shells was published by Prof. R. Tate and Mr. J. Brazier.[2] They enumerated fifty-four "Physa," more, as they point out, than half as many as were recorded for the whole world. They remarked on the unsatisfactory and indefinite knowledge of these species. In the following year, but without acquaintance with his predecessor's paper, Mr. E. A. Smith, of the British Museum, revised the Freshwater Shells of Australia. With additions proposed by himself he included fifty-two of "this neglected group" of Australian "Physa;"[3] but he thought that if his revision had been more complete, several species would be found endowed with a super-abundance of names.

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[1] R. T. Leiper—Proc. Roy. Soc. Medicine, ix., 1916, pp. 145-172.
[2] Tate & Brazier—Proc. Linn. Soc. N.S.Wales, vi., Dec. 1881, pp. 552-569.
[3] Smith—Journ. Linn. Soc. Zool., xvi., April, 1882, p. 275.

Induced by these expressions of discontent, Mr. A. H. Cooke undertook an enquiry,[4] "On the Generic Position of the so called *Physa* of Australia." He noted several probable synonymic assemblages of the species. On higher taxonomic levels he showed by radula characters that this group should be eliminated from *Physa* and linked with *Planorbis*. For its generic name he selected *Bulinus* proposed by Adanson in 1757. Unluckily for that conclusion, Adanson was a pre-linnean and not a binomial writer; his nomenclature is, therefore, ineffective. Apparently the place of *Bulinus* may be taken by *Bullinus* which according to Herrmannsen, was duly proposed by Oken.

Chiefly on the evidence of the radula, Cooke classifies *Bullinus* as "not so much a sinistral *Limnaea* as a spiral *Planorbis*." Reference of *Bullinus* and *Isodora* to the family Planorbidæ is further supported by the ciliated epidermis and by the filiform tentacles figured by Lesson,[5] Tate[6] and Cobb,[7] as well as by the non-digitate mantle figured by Chapman.[8]

This group presents the student with exceptional difficulties. The species appear to vary extremely and to limits not yet ascertained. With the honourable exception of Tate's essay in the Zoology of the Horn Expedition, the literature has multiplied names and ignored variation. In the present state of a world war the usual help from correspondents, such as comparison of specimens or drawings, cannot now be obtained. When a time of peace comes it will be necessary to institute a fuller comparison between our species and their reputed types abroad. Thus no positive conclusions are advanced and the matter that follows is presented rather as a means to further inquiry than as the finished result of investigation.

A chance handful from any pool is likely to present individuals with a longer and with a shorter spire. The first lesson to be learnt in studying this group is how changeable a character is this elevation of the spire. The presence or absence, spacing or punctuation, of spiral sculpture, can not be used as a safe guide to specific differentation. These features are the imprint of spiral threads or lines of ciliæ in the epidermis. But the epidermal coat varies in development according to local conditions, so that lines of ciliæ, which would apparently be otherwise developed, seem to be repressed in unfavourable environment. Yet some geographical series suggest that there are species which never develop such ciliæ.

A more abundant supply of lime allows a deposit on the inner lip and hence longitudinal streaks that mark previous rest stages.

The writer gratefully acknowledges the kindness of the Director of the National Museum, Melbourne, for the loan of types of Tenison Woods. Mr. C. J. Gabriel, who kindly relinquished in my favour the task of reporting on this material, also generously assisted me with the loan of specimens and with information. To Miss P. F. Clarke and Miss J. K. Allan, I am indebted for the illustrations which accompany this paper.

[4] Cooke—Proc. Zool. Soc., 1889, pp. 136-143.
[5] Lesson—Zool. Voy. Coquille, 1826, pl. xvi., fig. 5.
[6] Tate—Horn Exped., Zool., 1896, pl. xix., fig. 25.
[7] Cobb—Agric. Gazette N.S.Wales, ix., 1898, p. 182, fig. 2.
[8] Chapman—Mem. Nat. Mus. Melb., v., 1914, pl. i., figs. 2-3.

BULLINUS, *Oken.*

Bullinus, Oken, Lehrb. d. Naturgsch., iii., 1815, p. 303 (*fide* Herrmannsen, Indicis Gen. Malac., i., 1846, p. 147).

Bulinus, Adanson, Histoire Naturelle du Sénégal, 1757, p. 5, pl. i., fig. E. J. L. & Q.: Cooke, Proc. Zool. Soc., 1889, p. 142.

So far as I can ascertain the African species which Adanson studied has not been again recognised. The identity of the type is, therefore, obscure.

BULLINUS TENUISTRIATUS, *Sowerby.*

(Plate i., fig. 1-6; Pl. ii., fig. 15.)

Physa tenuistriata, Sowerby, Conch. Icon. xix., April, 1873, Pl. x., fig. 85; *Id.*, Tate & Brazier, Proc. Linn. Soc. N. S. Wales, vi., 1881, p. 556; *Id.*, Smith, Journ. Linn. Soc. Zool., xvi., 1882, p. 283; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1886, p. 313, Pl. 45, fig. 12; *Id.*, Billinghurst, Vict. Nat., x., 1893, p. 63; *Id.*, Tate, Rep. Horn Exped., Zool. ii., 1906, p. 212; *Id.*, Cherry, Bilharziosis, 1917, p. 4, Pl. i., fig. 8.

? *Physa smithi*, Clessin, Conch. Cab. i., Abth. 17, 1885, p. 294, Pl. 42, fig. 2-3.

Var. PUNCTURATUS—*Physa punctarata*, Sowerby, Conch. Icon., xix., 1874, Pl. i., fig. 5; *Id.*, Tate & Brazier, Smith and Clessin, *Op. cit.*

Var. TEXTURATUS—*Physa texturata*, Sowerby, Conch. Icon., xix., 1874, Pl. xii., fig. 95; *Id.*, Tate & Brazier, Smith and Clessin, *Op. cit.*

Var. ARACHNOIDEUS—*Physa arachnoidea*, Tenison Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 63; *Id.*, Tate & Brazier, Smith and Clessin, *Op. cit.*

Var. WATERHOUSEI—*Physa waterhousei*, Clessin, Conch. Cab., *Op. cit.* p. 361, Pl. 51, fig. 6.

There occurs in Victoria and South Australia, either a group of indefinite and closely allied species related to *Bullinus tenuistriatus* or one very variable species whose limits of aberration are not yet ascertained. Thus Tate writes (*Op. cit.*, p. 212):—"I have little doubt that *B. texturatus*, *B. punctaratus* and *B. tenuistriatus* are variants of one species." And Cooke (*Op. cit.*, p. 136, footnote) suggests a still broader union, connecting *B. texturatus* with *B. proteus*, Sowerby, *B. pyramidatus*, Sowerby, *B. dispar*, Sowerby, *B. pectorosa*, Conrad, *B. breviculmen*, Smith, *B. badia*, Adams & Angas, and *B. concinna*, Adams & Angas.

These opinions are entitled to serious consideration. I have not yet sufficient information either to confirm or to deny them.

B. TENUISTRIATUS (*sensu stricto*). It is to be regretted that when revising this group, Mr. E. A. Smith did not supplement with measurements and other details the incomplete original description of Sowerby. The type of *B. tenuistriatus* came from the Torrens River, near Adelaide, S. Australia. By means of specimens collected there and determined by Prof. Tate, I am enabled to recognise typical specimens in a lot collected at Overland Corner, Victoria by Mr. F. H. Taylor. One of these here figured (Pl. i., figs. 1-2.) is 13 mm. long and 9 mm. broad, very thin and transparent. The suture is margined beneath by a narrow pale line followed by a broader dark band, there is also a broad dark stripe within the outer lip. The sculpture consists of exceedingly delicate radial

threads which may or may not be broken into short lengths by spiral striæ. Mr. C. J. Gabriel also sends this form from Eddington on the Lodder River.

Var. TEXTURATUS—Sowerby writes of *Physa texturatus* that, "under a lens this appears as if impressed with a fine woven fabric." From this I understand that it is distinguished from typical *B. tenuistriatus* by the impressed spiral lines. Answering to such a description is a specimen, 18 mm. long and 10 mm. broad from the Wimmera River (Cox Coll.) here figured (Pl. i., figs. 3-4). Similar specimens are before me from Mt. Benalla (G. B. Pritchard), Stawell (T. L. Billinghurst), and Canfield (C. J. Gabriel). Smith reports it as collected by Mr. R. Etheridge, Junr., at Sutton Grange. That gentleman now tells me that he obtained it in 1867, near Mt. Alexander, not far from Castlemaine.

Var. PUNCTURATUS. A form here provisionally identified as *Physa puncturatus*, Sowerby, was gathered by Mr. W. Kershaw in the "Murray Swamps." The sculpture has minute spaced tubercles, arranged in wide spiral lines. The effect is that of the hair scars of *Chloritis*. An example drawn (Pl. i., fig. 5-6.) is 20 mm. long and 11 mm. broad.

Var. WATERHOUSEI. To this species of Clessin is now with hesitation referred a bulimoid form with rounded whorls and elevate spire. The specimen figured (Pl. i., fig. 7-8.) is 20 mm. long and 11 mm. broad. It was given to the Rev. J. E. Tenison Woods by Mr. W. Kershaw, who took it in the "Murray River." A similar form is in the Cox Collection from Gun-bower and from the Wimmera River.

Var. ARACHNOIDEUS. The types lent by the National Museum, Melbourne, consist of four specimens, labelled "*Physa arachnoidea*, Ten. Woods. Type. Near Melbourne. 36001-5." One of these here figured (Pl. ii., fig. 15.) is 13 mm. in length and 6 mm. in breadth. It is a comparatively small and slender form. Even among the type lot there is a difference in sculpture; all have fine, dense, radial hair lines, on one no spiral sculpture is perceptible, on another there are spiral lines of rather distant ciliæ, which correspond to spiral lines on the bare shell. The suture, like that of var. *texturatus*, is frequently edged by a pale above a dark line. The shape is fairly constant. It is common and widespread in Victoria, before me are specimens from Castlemaine (T. L. Billinghurst), Melbourne (Major Cherry), Echuca (Cox Coll.), Williamstown (C. J. Gabriel) and Overland Corner (F. H. Taylor).

BULLINUS TENUISTRIATUS, var. CONFLUENS,[9] *var. nov.*

(Plate i., fig. 9-10.)

Shell elliptical, large and thin, narrowly umbilicate. Spire short with concave outline. Last whorl rapidly increasing, compressed at the periphery. Sculpture, fine and dense radial hair riblets. Length 21 mm., breadth 12 mm.

Hab.—Echuca (type) and Gun-bower (Cox Coll.), Lake Hatton or Haddah (C. J. Gabriel).

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[9] In reference to "Echuca," meaning in the native language "meeting of the waters" of the Murray, Goulburn and Campaspe Rivers.

This form makes a nearer approach to *Physa australiana*, Conrad,[10] than to any other figured species. But that is shown with the anterior lip contracted to a gutter and with a more gibbous shoulder. Conrad's species is 18 mm. long and comes from the Bogan River, N. S. Wales. Probably the type of it is still preserved in the Museum at Logan Square, Philadelphia.

Bullinus acutispira, *Tryon.*

(Plate i., fig. 11-12; Plate ii., fig. 16.)

Physa acutispira, Tryon, Am. Journ. Conch., ii., 1866, p. 9, Pl. ii., fig. 10; *Id.*, Tate & Brazier, Proc. Linn. Soc. N. S. Wales, vi., 1881, p. 557; *Id.*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 282, Pl. vi., fig. 16; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1885, p. 242, Pl. xxxiv., fig. 1.

Var. yarraensis—*Physa yarraensis*, Tenison Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 64; *Id.*, Tate & Brazier; Smith & Clessin, *Op. cit.*

Var. tenuilirata—*Physa tenuilirata*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 291, Pl. vi., fig. 27.

Var. etheridgii—*Physa etheridgii*, Smith. Journ. Linn. Soc., Zool., xvi., 1882, p. 288, Pl. vi., fig. 25; *Id.*, Clessin, *Op. cit.*

As here construed, *B. acutispira* agrees with *B. tenuistriatus* in the appearance and variation of the sculpture. It is, however, always a smaller, more slender shell, with a sharply pointed and elevated spire. The type is probably preserved in the Museum of the Academy at Philadelphia. It was 12 mm. long and was compared by the author to the common European *Physa hypnorum*. The locality was not described more definitely than "Australia."

Var. yarraensis—The National Museum, Melbourne has forwarded to me three imperfect specimens, labelled "*Physa yarraensis*, Ten. Woods. Type. Upper Yarra. No. 35998-36000." One of these, figured at Pl. ii., fig. 16, is 11 mm. long and 6 mm. broad. It is thin and transparent and sculptured by distant spiral lines of ciliæ. This variety has also been sent from Carrun Creek, Frankston, by Mr. T. Worcester.

Another variety, which in the confused state of nomenclature, it seems unwise for me to name, is figured at Pl. i., fig. 11-12. It is 11 mm. long and 5 mm. broad, with a very tall and slender spire. It was sent by Mr. C. J. Gabriel from Horsham.

Another form is shown at Pl. i., fig. 13, is 13 mm. long and 6 mm. broad, more ovate in shape and more solid in substance. This is sent by Mr. Gabriel from Cape Grant, near Portland.

Mr. E. A. Smith has reported *P. etheridgii* from the Yan Yean Reservoir and a variety of *P. tenuilirata* from the Bunyip River.

Bullinus aliciæ, *Reeve.*

(Plate i., fig. 14, Plate ii., fig. 17-18)

Physa (Ameria) aliciæ, Reeve, Proc. Zool. Soc., 1862, p. 106, text figg.; *Id.*, Sowerby, Conch. Icon., xix., 1874, Pl. i., fig. 6a not 6b; *Id.*, Tate

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[10] *Physa australiana*, Conrad, Proc. Acad. Nat. Sci. Philad., v., 1850, p. 11; *Id.*, Conrad, Am. Journ. Conch., ii., 1866, p. 81, Pl. i., fig. 7; *Id.*, Paetel, Cat. Conch. Samml., ii., 1889, p. 403. *? Physa krefftii*, Clessin (emend), Conch. Cab. i., Abth. 17, 1886, p. 370, Pl, liv., fig. 12.

& Brazier, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 558; *Id.*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 293; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1885, p. 298, Pl. xliii., fig. 2-5; *Id.*, Cooke, Proc. Zool. Soc., 1889, p. 140, fig. 5.

Amplexa turrita, Tate, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 409.

Physa turriculata, Tate & Brazier, *Op. cit.*, p. 558 (Not *Bulla turrita*, Gmelin, Syst. Nat., xiii., 1791, p. 3428, nor *Physa turriculata*, Morelet, Voy. Welwitsch, 1868, p. 92, Pl. ix., fig. 6.)

Var. KERSHAWI—*Physa kershawi*, Ten. Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 64; *Id.*, Smith, Tate & Brazier; and Clessin, *Op. cit.*

Var. CINGULATA—*Physa cingulata*, Clessin, Conch. Cab. i., Abth. 17, 1886, p. 364, Pl. li., fig. 8; *Bullinus alicia*, var. *cingulatus*, Billinghurst, Victorian Naturalist, x., 1893, p. 63.

Herewith is figured the sole type of *Physa kershawi*, Ten. Woods (Pl. ii., fig. 17) from the Upper Yarra, No. 36083 of the National Museum, Melbourne, 7 mm. long, 3.5 mm. broad. In support of the above synonymy, I also illustrate an authentic specimen of *Amplexa turrita* from Ballarat (Pl. i., fig. 14) 20 mm. long and 7 mm. broad, received by the Australian Museum, thus labelled from Prof. R. Tate. I also figure (Pl. ii., fig. 17) the apex of a specimen collected at Lal-lal by Mr. Kershaw. The number and importance of the spiral ridges are, as Smith has already remarked, quite variable.

Hab.—Ballarat (R. Tate), Castlemaine (Billinghurst), Lal-lal (W. Kershaw) and Avon River (C. J. Gabriel).

BULLINUS PECTOROSUS, *Conrad.*

Physa pectorosus, Conrad, Proc. Acad. Nat. Sci. Philad., v., 1850, p. 11, and Am. Journ. Conch., ii., 1866, p. 81, Pl. i., fig. 11; *Id.*, Tate & Brazier, Proc. Linn. Soc. N. S. Wales, vi., 1881, p. 556; *Id.*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 279, Pl. vi., fig. 11; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1885, p. 245, Pl., xxxvi., fig. 10; *Id.*, Cooke, Proc. Zool. Soc., 1889, p. 136, footnote; *Id.*, Billinghurst, Victorian Naturalist, x., 1893, p. 63; *Id.*, Tate, Rep. Horn Exped., Zool., ii., 1906, p. 212.

Physa pinguis, Sowerby, Conch. Icon., xix., 1874, Pl. xii., fig. 93.

Mr. Billinghurst has recorded this species as rare at Castlemaine. I fear that I was responsible for this identification. This Castlemaine form I now consider to be *B. tenuistriatus* var. *arachnoideus*, Ten. Woods.

ISODORA, *Ehrenberg.*

Isodora, Ehrenberg, Symbol. Phys. Mollusc., &c., 1831, no pagination (fide Germain in de Kerville, Voy. en Kroumisie, Zool. 1908, p. 249); type *Isodora brocchii*, Ehrenberg, a variety of *I. contorta*, Michaud, from North Africa.

Isidorella, Tate, Rep. Horn Exped., Zool., ii., 1896, p. 212; type, *Physa newcombi*, A. Adams & Angas, 1863, from Central Australia.

Professor R. Tate correctly segregated from the "Australian Physæ," a group of species in which the columella has no fold. These are readily separated from those above called *Bullinus* by that feature and by a more

rotnnd form. To the diagnosis of Prof. Tate, I would now add that *Isidorella* has the first whorl wonnd in the same plane, whereas the initial whorls of *Bullinus*, including *Ameria*, are upthrust or mncronate.

Prof. Tate instituted *Isidorella* "on the assnmption that the lingnal ribbon will afford differential characters," from *Isodora;* but it has not done so. For Cooke showed that the radula of *Isidorella physopsis* is of the same pattern as that of *Ameria alicia* or of *Isodora contorta*. Though geographical discontinnity might have encouraged Prof. Tate to hold these forms apart, this argument was subsequently weakened by the appearance of *Isodora* in the Molnccas, Celebes and Asia Minor. In Kuster's figure of *I. braccliii*,[11] the colnmella is shown to be without a fold. The weight of evidence is thus towards uniting rather than towards dividing *Isidorella* from *Isodora*.

ISODORA HAINESII, *Tryon*.

(Plate ii., fig. 19-20-21.)

Physa (Isidora) hainesii, Tryon, Am. Journ. Conch., ii., 1866, p. 9, Pl. ii., fig. 9; *Id.*, Tate & Brazier, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 556; *Id.*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 281; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1886, p. 366, Pl. xlix., fig. 1; *Id.*, Cooke, Journ. of Conch., v., 1887, p. 241.

Physa latilabiata, Sowerby, Conch. Icon., xix., 1873, Pl. v., fig. 33.

Physa ciliosa, Clessin, mss., *Op. cit.*, 1886, p. 351.

Physa schrayeri, Clessin, mss., *Op., cit.*, 1886, p. 366.

Var. PILOSA—*Physa pilosa*, Ten. Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 63; *Id.*, Tate & Brazier; Smith and Clessin, *Op. cit.*

Var. CREBRECILIATA—*Physa crebreciliata*, Ten. Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 63; *Id.*, Tate, Brazier and Smith, *Op. cit.*; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1886, p. 351, Pl. xlix., fig. 10; *Id.*, Chapman, Mem. Nat. Mus. Melb., v., 1914, p. 58, Pl., i., fig. 2.

Physa hirsuta, Ten. Woods, mss.

Var. BRAZIERI—*Physa brazieri*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 286, Pl. vi., fig. 22; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1885, p. 237, Pl. xxxvi., fig. 3; *Id.*, Tate, Rep. Horn Exped., Zool., ii. 1896, p. 215.

Some of the names listed above were subordinated by Prof. Tate to *I. newcombi*. Though impressed by his views, I prefer, for the present, to hold that apart. *I. hainesii*, as understood here, is a smaller and more elongate form, which extends to the Pacific coast, while the larger *I. newcombi* seems not to do so.

As pointed out by Smith in the case of *I. brazieri*, the species varies in colour from dark horn brown to pale straw; the spire is more or less elevated and the epidermis is at times more dense and profusely ciliated than at others. The pattern which the epidermis impresses on the shell varies relatively.

[11] Kuster—Conch. Cab., i., 1862, Pl. xii., fig. 17-19.

Preserved in Melbourne are four specimens labelled as the types of *Physa pilosa* and registered as 35994-7. The locality is not stated in the description, but these types are labelled "University Ponds." One of these is here illustrated (Pl. ii., fig. 19-20), 13 mm. long and 8 mm. broad. In the original account Tenison Woods doubted if *P. pilosa* was specifically distinct from *P. crebreciliata*, over which it has page precedence. *P. pilosa* is a pale clear isabelline colour, whereas *P. crebreciliata*, is dark brown. *P. pilosa* has also a lower spire, a narrower form and a less developed epidermis than *P. crebreciliata*.

The type of *P. crebreciliata* does not exist under that name in the collection of the Museum at Melbourne. But I have received four specimens, marked "36028-31, *Physa hirsuta*, Ten. Woods, Caulfield." No such species was published by Tenison Woods. The locality, description and comparison of *P. crebreciliata* suit "*hirsuta*," exactly. I presume, therefore, that the name was changed in course of publication, and that the real types of "*crebreciliata*" are the specimens marked "*hirsuta*." These specimens are less globose than the original figure published by Clessin and closely correspond to *Physa brazieri*, Smith, var. *major*, from the Burnett River, Queensland. There are on the body whorl about thirty-two spirals of fine ciliæ, decussated by fine close longitudinal lamellæ. The latter, as in the case of *I. newcombi*, rise round the suture into a sort of ruff or collar. But the epidermis is rarely preserved in so perfect a state. Of the four type specimens, the one which is drawn (Pl. ii., fig. 21) has a comparatively elevated spire, while in the other three the spire is much more depressed. It is 12 mm. long and 8 mm. broad.

ISODORA NEWCOMBI, *Adams & Angas.*

Physa newcombi, A. Adams & Angas, Proc. Zool. Soc., 1863, p. 416 (April, 1864); *Id.*, Sowerby, Conch. Icon., xix., 1873, Pl. iii., fig. 21; *Id.*, Tate & Brazier, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 555; *Id.*, Smith, Journ. Linn. Soc., Zool., xvi., 1882, p. 280; *Id.*, Clessin, Conch. Cab., i., Abth. 17, 1885, p. 299, Pl. xliii., fig. 6; *Id.*, Cooke, Journ. of Conch., v., 1887, p. 242.

Isidorella newcombi, Tate, Rep. Horn Exped., Zool. ii., 1906, p. 213, Pl. xix., fig. 25.

? Physa subinflata, Sowerby, Conch. Icon., xix., 1874, Pl. i., fig. 6a, not 5.

Var. INFLATA—*Physa inflata*, Adams & Angas, Proc. Zool. Soc., 1864, p. 39; *Id.*, Sowerby, Conch. Icon., xix., 1874, Pl. i., fig. 4.

Var. PHYSOPSIS—*Limnæa physopsis*, Cooke, Journ. of Conch., v., 1887, p. 243, Pl. ii., fig. 1-4; *Id.*, Proc. Zool. Soc., 1889, pp. 137-140, fig. 7.

Prof. Tate notes that in arid regions this species prepares for æstivation by burrowing into the mud and closing the aperture with a hemispheric lid of fine silt.

Hab.—Typical form, Bacchus Marsh and Stawell (T. L. Billinghurst); var. *inflata*, Mount Hope.